WHEEL BEARING ARRANGEMENTS

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Cited documents:

EP0418532 (A1)

WO8602607 (A1)

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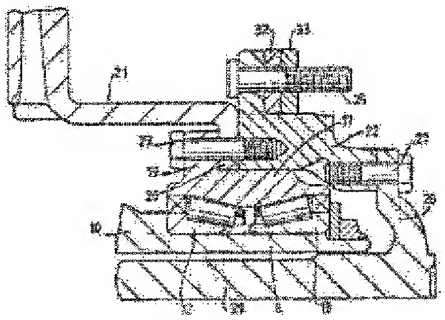
Abstract of **WO 9513198 (A1)**

A preset and prelubricated bearing (11) suitable for use with floating rear drive axle shafts of larger automotive trucks, has inner and outer race rings (12, 13, 17) with rollers (18) located between. The bearing (11) is sealed by means of seals (34) at each end of the race rings. The outer race ring (17) has a radial flange (19) to which the inner flange (20) of a brake arrangement (21) is attached by means of bolts (23). A flange ring (22) is also attached to the radial flange (19) by the bolts (27) which provides for attachment to the wheels of the truck and to the axle shaft. The bearing (11) enables disk brakes to be used on medium and heavy duty trucks.



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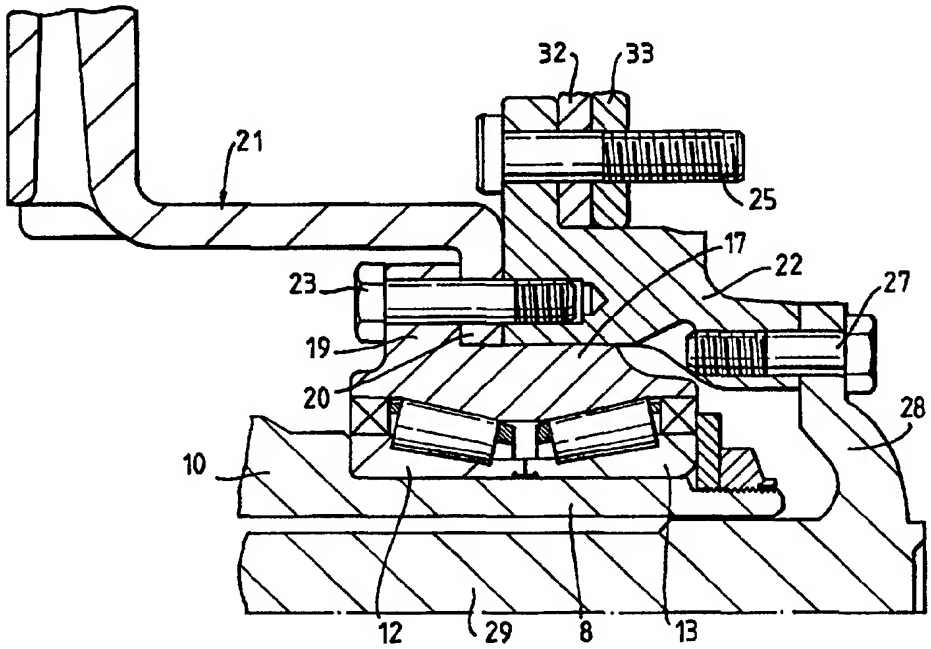

(57) Abstract

A preset and prelubricated bearing (11) suitable for use with floating rear drive axle shafts of larger automotive trucks, has inner and outer race rings (12, 13, 17) with rollers (18) located between. The bearing (11) is sealed by means of seals (34) at each end of the race rings. The outer race ring (17) has a radial flange (19) to which the inner flange (20) of a brake arrangement (21) is attached by means of bolts (23). A flange ring (22) is also attached to the radial flange (19) by the bolts (27) which provides for attachment to the wheels of the truck and to the axle shaft. The bearing (11) enables disk brakes to be used on medium and heavy duty trucks.

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WHEEL BEARING ARRANGEMENTS

The present invention relates to wheel bearing arrangements and is more particularly concerned with the bearing arrangements for the axles of the wheels of automotive vehicles.

Packaged wheel bearing assemblies facilitate the assembly of automobiles and to a large measure have replaced separate single row bearings at wheel locations. The typical packaged wheel bearing includes inner and outer races, rolling elements arranged in two rows between the races, and seals at the ends of the bearing for retaining a lubricant and exclude contaminants. This bearing, which comes prelubricated and preset is installed as a unit during the assembly of the vehicle. The assembler need not bother with the installation of seals, the application of lubrication, or adjustment, these procedures all having been completed by the bearing manufacturer.

Larger automotive vehicles, such as medium and heavy duty trucks, rely on more traditional bearing arrangements, particularly at rear drive wheels. Here the typical truck has a solid axle housing containing a differential midway between its ends. So-called floating axle shafts extend through the axle housing from the differential and emerge from the end of the housing. Here they are coupled with hubs which rotate on the axle housing, indeed on tapered roller bearings fitted around the ends of the housing. The road wheels are bolted to the hubs. Each hub typically rotates on two single row tapered roller bearing which, as part of the assembly procedure, are manually adjusted, one against the other, to provide the bearing arrangement with the desired setting. Where the bearings are large this is a demanding procedure. Moreover the assembler must apply the proper amount of lubricant to the bearings and install seals as well. Often these procedures are also undertaken at repair facilities

where they are even more demanding. Certainly, the procedures consume more time and require greater skills than simply installing or removing a package bearing.

Apart from that, disk brakes are generally more effective than drum brakes, yet they are rarely installed on medium and heavy duty trucks. Package bearings, being smaller than traditional hubs or drive axles, afford greater space for accommodating brakes and permit increased swept area.

The present invention seeks to provide a packaged bearing arrangement which is arranged for use with fully floating axle arrangements and is thus suited for use on axle housings of medium and heavy trucks and which adapts itself to disk brakes.

According to the present invention there is provided a wheel bearing arrangement comprising an outer race ring having two raceways, two inner race rings disposed radially inwardly of the outer race ring and having respective raceways disposed opposite the two raceways of the outer race ring, and rolling elements in rolling engagement in the raceways of the inner and outer race rings, the outer race ring having a radially outwardly directed flange member which includes attachment means for attachment to one or more further flange members.

In this way a packaged bearing unit suitable for use with medium and heavy duty trucks is achieved. In this context packaged is to be understood to refer to a preadjusted bearing arrangement which might also be prelubricated and presealed but not necessarily.

Preferably, a flange ring is provided for the attachment of at least one vehicle wheel, the flange ring being one of said one or more further flange members to which the flange member of said outer race ring is attached. The flange ring may be adapted to have bolted thereto the drive flange of an axle shaft which is to extend through the bearing arrangement.

Also, the flange member of the outer race ring may be arranged to be secured to a second further flange member which is the brake flange of a brake member.

In one embodiment of the present invention the flange member of the outer race ring has an inboard surface against which the brake flange of the brake member is secured and an outboard surface against which the flange ring is secured.

In an alternative embodiment of the present invention the flange member of the outer race ring has an inboard surface and an outboard surface against which the brake flange of the brake member is secured, the brake flange being in turn secured to the flange ring.

The present invention will now be described by way of example only with reference to the accompanying drawings, in which:

Figure 1 shows in axial section a first embodiment of a bearing arrangement in accordance with the present invention;

Figure 2 shows in axial section a second embodiment of a bearing arrangement in accordance with the present invention;

Figure 3 shows in axial section a third embodiment of a bearing arrangement in accordance with the present invention;

Figure 4 shows in axial section a fourth embodiment of a bearing arrangement in accordance with the present invention; and

Figure 5 shows in axial section a fifth embodiment of a bearing arrangement in accordance with the present invention.

Referring to Figure 1, a spindle 8 at the end of an axle housing 10, e.g. of a commercial vehicle, carries a double-row tapered roller bearing 11. Two

inner race rings 12 and 13 of the bearing 11 are clamped against a shoulder 14 of the axle housing 10 and are in abutment with each other by a threaded clamping ring 15 which is engaged on the end of the spindle 8 and which abuts the race ring 13 through a washer 16. A single outer race ring 17 has raceways disposed radially opposite the raceways in the inner rings 12 and 13 and two rows of tapered rollers 18 are engaged in the raceways of the inner and outer race rings 12, 13 and 17. The rollers 18 of the two rows are orientated in opposite directions, that is with the small ends of the rollers 18 in the two rows presented toward each other. This enables the bearing 11 to accommodate loads in both axial and radial directions. Since end faces of the inner race rings 12 and 13 abut within the confines of the outer race ring 17, the bearing 11 is preset with a prescribed preload or end play, this setting being established at the factory where the bearing 11 is manufactured. Typically, the commonly abutting end face of one of the race rings 12 or 13 is ground down until the bearing 11 has the correct preload or end play.

The outer race ring 17 has a flange 19 which extends radially from substantially centrally of the bearing 11 and which is provided with through holes, and the inner flange 20, brake disc 21 and an adaptor or a flange ring 22 abut the radial flange 19 at opposite sides. Bolts 23 extend through aligned holes in the two flanges 19 and 20 and engage in screw-threaded bores in the flange ring 22 to clamp the three components together. The flange ring 22 has a radially outwardly extending flange 24 provided with threaded bolts 25 for the attachment of a wheel of the vehicle. The flange ring 22 also has an axially projecting part 26 formed with a ring of threaded bores receiving bolts 27 by which a drive flange 28 on the end of an axle

shaft 29 is secured to the flange ring 22. At the axial side of the part 26 remote from the drive flange 28, profiled recesses or pockets 30 are formed at the locations of the threaded bores so that the bores open to the pockets 30. The profiling of the pockets 30 reduces stress concentrations at these locations. The radially outer surface 31 of the axially extending part 26 assists in locating dual wheels 32 and 33 generally during attachment of the wheels 32 and 33 to the flange 24.

The outer race ring 17 at its ends is fitted with seals 34 which encircle the inner race rings 12 and 13 at their ends beyond the two rows of rollers 18. The seals 34 establish static and dynamic fluid barriers at the ends of the bearing 11, and as such exclude contaminants from the interior of the bearing 11, that is from the annular space between the inner race rings 12 and 13, on the one hand, and the outer race ring 17 on the other. This space contains a grease-type lubricant and the seals 34 further serve to retain the lubricant in the space.

The bearing 11 is furnished as a preassembled, prelubricated, and preset unit. The two inner race rings 12 and 13 are held together by a clip 35 which bridges the interface between the two inner race rings and engages both of the race rings. Even in the absence of the clip 35 the seals 34 would serve to prevent the inner race rings 12 and 13 from leaving the interior of the outer race ring 17. In short, the bearing 11 is unitized or packaged.

To install the bearing 11 on the axle housing 10, the brake disk 21 and the flange ring 22 is first attached to the outer race ring 17 with the bolts 23. Then, with the axle shaft 29 withdrawn from the axle housing 10 and the threaded clamping ring 15 and washer 16 removed from the end of the axle housing 10, the

bearing 11 is fitted over the spindle 8 on the end of the housing 10. Specifically, the inner race rings 12 and 13 are fitted over the spindle 8 followed by the washer 16. The clamping ring 15 is then engaged with the threads on the end of the spindle 8 and turned down hard against the washer 16, thus clamping the two inner race rings 12 and 13 snugly between the shoulder 14 and the washer 16. Now the axle shaft 29 may be inserted into the open end of the axle housing 10 and advanced until its drive flange 28 comes against the axial part 26 of the flange ring 22, whereupon it is secured to the flange ring 22 with bolts 27. Finally, the dual wheels 32 and 33 are fitted over the surface 31 of the flange ring 22 and brought up to the flange 24 on that ring. The outer surface 31 of the flange ring 22 serves as a pilot for the dual wheels. Flange nuts thread over the bolts 25 to secure the wheels 32 and 33 to the flange ring 22. In comparison to the installation of traditional wheel hubs on axle bearings, the installation of the bearing 11 requires the handling of considerably less parts and fully eliminates adjustments.

In an alternative arrangement shown in Figure 2, in which corresponding parts are indicated by the same reference numerals, the outer race ring 17 is axially extended and the bolts 27 securing the drive flange 28 of the axle shaft 29 are received in threaded holes in the adjacent overhanging end of the flange 19 of the outer race ring 17. The flange ring 22 has a radially inner portion 36 with holes aligned with the holes in the part 20 of the disc element 21 and the bolts 23 extend through these holes into threaded holes 37 in the outer race ring 17. The radially outer parts of the flange ring 22 carry the bolts 25 for the attachment of the wheels 32 and 33. An axial part 38 of the ring 22 fits about the periphery of the outer

race ring 17, and its outer surface 31 assists in locating the dual wheels 32 and 33 during attachment of the wheels 32 and 33 to the flange 24.

The arrangement shown in Figure 3 is similar to that of Figure 2, and again corresponding parts are indicated by the same reference numerals. In this arrangement, however, threaded bolt holes 37 extend through the full axial extent of the flange 19 of the outer race ring 17 and receive both the bolts 23 for the attachment of the brake disc 21 and the inner portion of the flange ring 22 and the bolts 27 for the attachment of the drive flange 28 of the axle shaft 29. Thus, the bolts 23 and the bolts 27 are concentrically aligned although it is not necessary for the bolts 23, 27 to be of the same diameter.

In the arrangements illustrated in Figure 1-3 the inner flange 20 for the brake disc 21 lies along the inboard face of the outwardly directed radial flange 19. As a consequence, the bearing 11 must be removed from the spindle 8 of the axle housing 10, or at least disassembled in order to remove the brake disc 21.

In the arrangements illustrated in Figures 4 and 5 the radial flange 19 of the outer race ring 17 extends outwardly from a position near to or adjacent the inboard end of the bearing 11. The brake disc 21 as a result extends over and beyond the flange 19. The inner flange 20 of the brake disc 21 lies against the outboard face of the radial flange 19 on the outer race ring 17 and the flange ring 22 lies against the outboard face of the inner flange 20 of the brake disc 21. The bolts pass through the flange 19 of the outer race ring 17 and the flange 20 of the brake disc 21 and into the flange ring 22 which is threaded, holding the three together. Corresponding parts are indicated by the same reference numerals as appropriate.

To remove the brake disc for facing or replacement, one first removes the flange nuts that thread over the wheel bolts 25 and then withdraws the wheels 32 and 33 from the bolts 25 and flange ring 22. Preferably, at that time the bolts 27, which secure the drive flange 28 of the axle shaft 29 to the flange ring 22, are removed and the axle shaft 29 is withdrawn from the axle housing 10. Finally, the bolts 23, which hold the outer race ring 17, the brake disc 21 and the flange ring 22 together, are removed to free the flange ring 22 and the brake disc 21. The brake disc 21 passes freely over the radial flange 19 of the outer race ring 17, leaving the bearing 11 intact on the spindle 8 of the axle housing 10.

In the arrangement shown in Figure 5 the holes in the radial flange 19, the inner flange 20 of the brake disc 21 and the flange ring 22 for receiving bolts 23 and 27 are aligned in a manner similar to that of Figure 3.

The bearing 11, irrespective of the specific arrangement, is furnished as a package and as such is preset and prelubricated. It installs easily and quickly over the spindle 8 on the axle housing 10 and as such facilitates the assembly of trucks which utilise such axle housings. Moreover, the illustrated arrangements are designed to satisfy a requirement for improved braking in commercial vehicles by enabling disc brakes to be used instead of drum brakes. These arrangements permit more efficient mounting of disc brakes. In addition, the illustrated arrangements optimise the radial cross-section between the inside of the road wheels 32, 33 and the axle casing 10, which allows a larger brake disc to be employed, maximising braking effort. Alternatively, when smaller diameter wheels are required, for example, to increase load carrying volume or to lower the vehicle height, the

swept area of the brake disc 21 can be maintained by using these arrangements. It will be appreciated that with the arrangements shown the flange ring 22 may be made of a non-ferrous material. Since the size of the bearing 11 is smaller than for conventional bearing arrangements for medium and heavy trucks, the weight of the bearing is reduced and can be reduced even further when non-ferrous materials are used for some of the components. Although not significant with respect to the total weight of such vehicles, even a small reduction in weight is welcomed by vehicle manufacturers since this in turn increases the total payload and improves efficiency. In addition, the arrangements described above require a smaller number of individual components which means that the tolerances which have to be allowed for can be reduced thereby improving braking performance even when drum brakes are used.

The raceways of the outer ring 17 illustrated in each of Figures 1 through to 5 are located directly on the ring. They may also be located on separate races, often called cups, which are installed in the ring 17, although that would increase the diameter of the ring 17. Moreover, a brake drum may be substituted for the brake disc 21 in appropriate circumstances. Also, instead of dual wheels 32, 33 a single wheel may be secured to the flange ring as desired.

CLAIMS

1. A wheel bearing arrangement comprising an outer race ring having two raceways, two inner race rings disposed radially inwardly of the outer race ring and having respective raceways disposed opposite the two raceways of the outer race ring, and rolling elements in rolling engagement in the raceways of the inner and outer race rings, the outer and inner race rings being packaged and adapted for mounting on a fully floating axle arrangement and the outer race ring having a radially outwardly directed flange member which includes attachment means for attachment to one or more further flange members.

2. A wheel bearing arrangement as claimed in claim 1, wherein the flange member is adapted to have secured thereto a drive flange of an axle shaft of the fully floating axle arrangement which is to be supported in the bearing arrangement.

3. A wheel bearing arrangement as claimed in claim 2, further including a flange ring for the attachment of at least one vehicle wheel, the flange ring being one of said one or more further flange members to which the flange member of said outer race ring is attached.

4. A wheel bearing arrangement as claimed in claim 3, wherein the attachment means of the flange member of the outer race ring are holes, and there is further provided bolts which pass through the holes in the flange member for engagement with the flange ring.

5. A wheel bearing arrangement as claimed in claim 4, wherein the flange ring is adapted to have bolted thereto the drive flange of the axle shaft which is to extend through the bearing arrangement.

6. A wheel bearing arrangement as claimed in claim 5, wherein the holes in the flange member of the

outer race ring and the threaded holes in the flange ring are arranged circumferentially.

7. A wheel bearing arrangement as claimed in claim 6, wherein the flange member of the outer race ring is arranged to be secured to a second further flange member which is the brake flange of a brake member.

8. A wheel bearing arrangement as claimed in claim 7, wherein the flange member of the outer race ring has an inboard surface against which the brake flange of the brake member is secured and an outboard surface against which the flange ring is secured.

9. A wheel bearing arrangement as claimed in claim 8, wherein the holes in the flange member of the outer race ring are through holes for receiving at opposite axial ends thereof bolts for the attachment of the brake flange and the flange ring.

10. A wheel bearing arrangement as claimed in claim 8, wherein the flange ring includes threaded holes to receive bolts for the attachment of the drive flange, the holes opening at their end remote from the drive flange in pockets which are profiled in a manner to reduce stress concentrations.

11. A wheel bearing arrangement as claimed in claim 7, wherein the flange member of the outer race ring has an inboard surface and an outboard surface against which the brake flange of the brake member is secured, the brake flange being in turn secured to the flange ring.

12. A wheel bearing arrangement as claimed in any one of claims 3 to 11, wherein the flange ring also has an axially directed surface which serves to locate at least one wheel radially on the flange ring.

13. A wheel bearing arrangement as claimed in any one of the preceding claims, wherein the raceways and the rolling elements are configured and arranged

such that the rolling elements transfer radially directed loads and axially directed loads between the outer and inner race rings.

14. A wheel bearing arrangement as claimed in any one of the preceding claims, wherein sealing elements are provided between the inner and outer race rings for sealing a lubricant and the rolling elements within the inner and outer race rings thereby providing a presealed, prelubricated packaged bearing arrangement.

Fig.1.

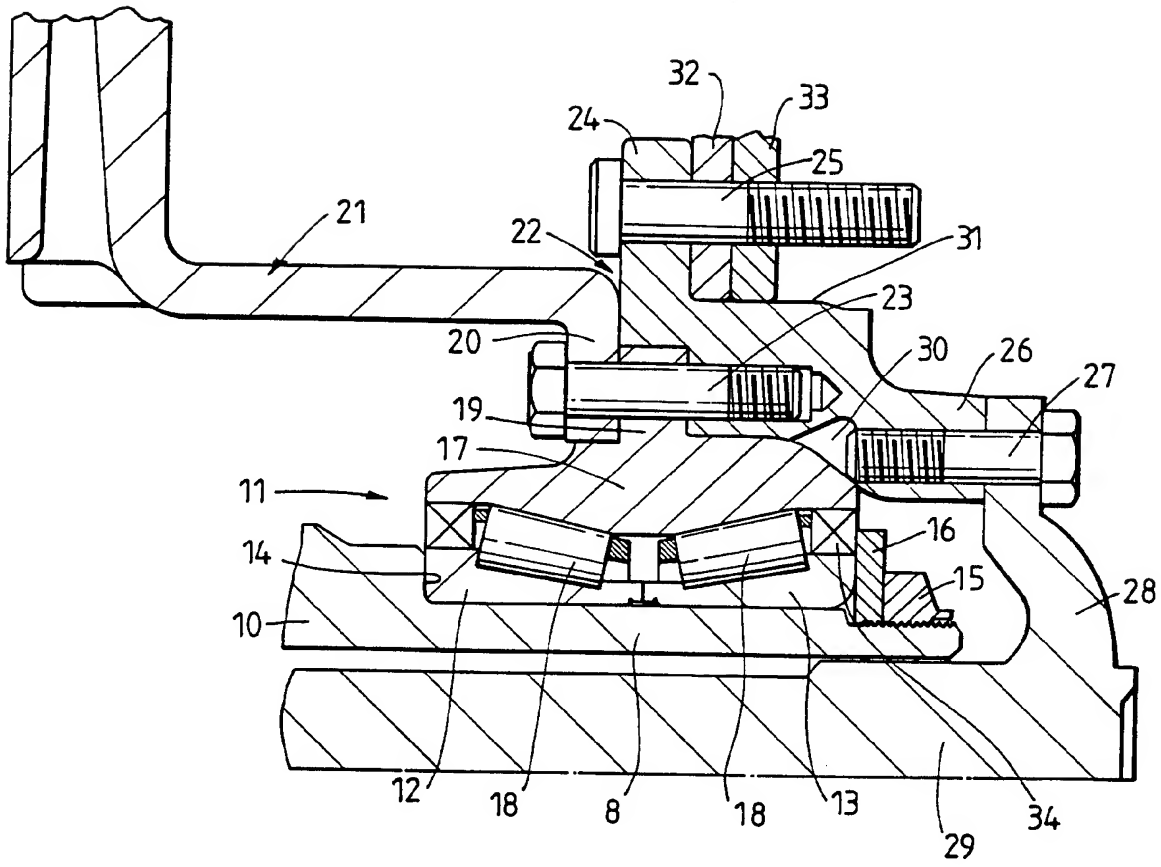
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Fig.2.

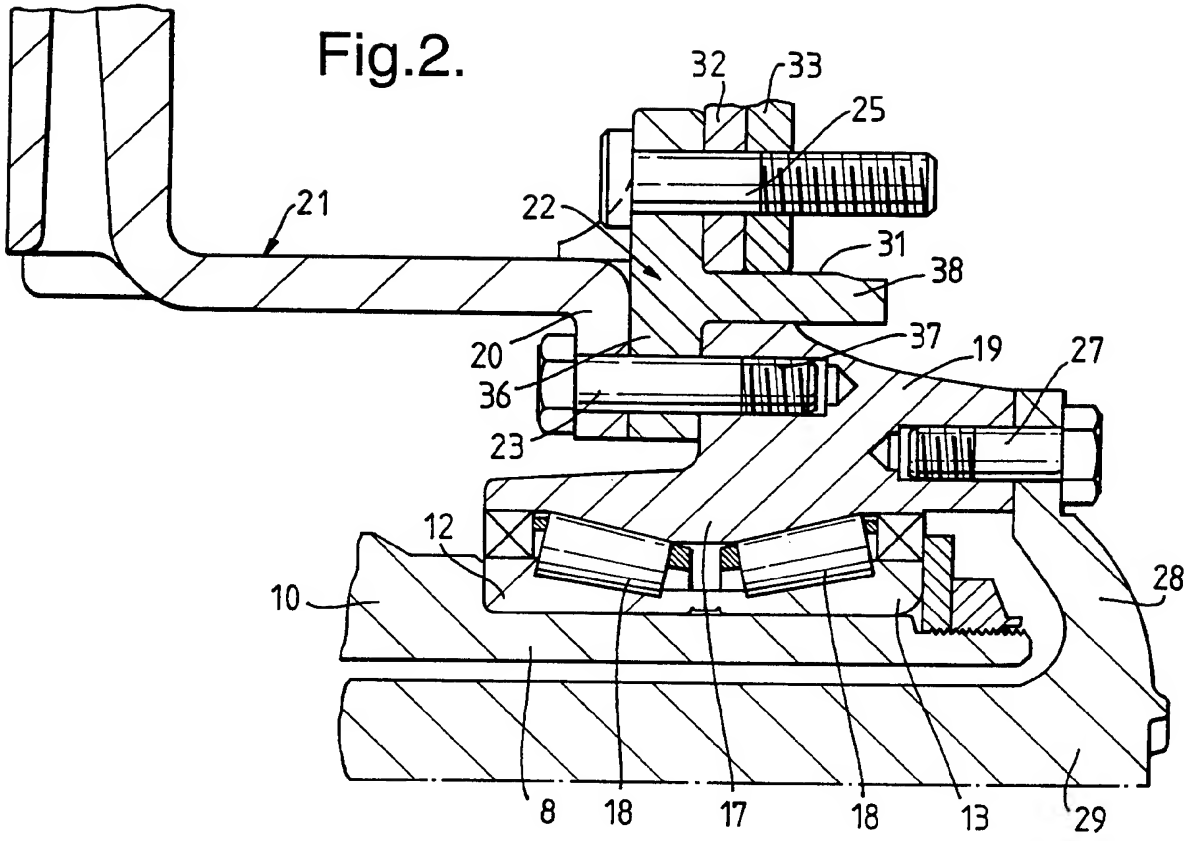
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Fig.3.

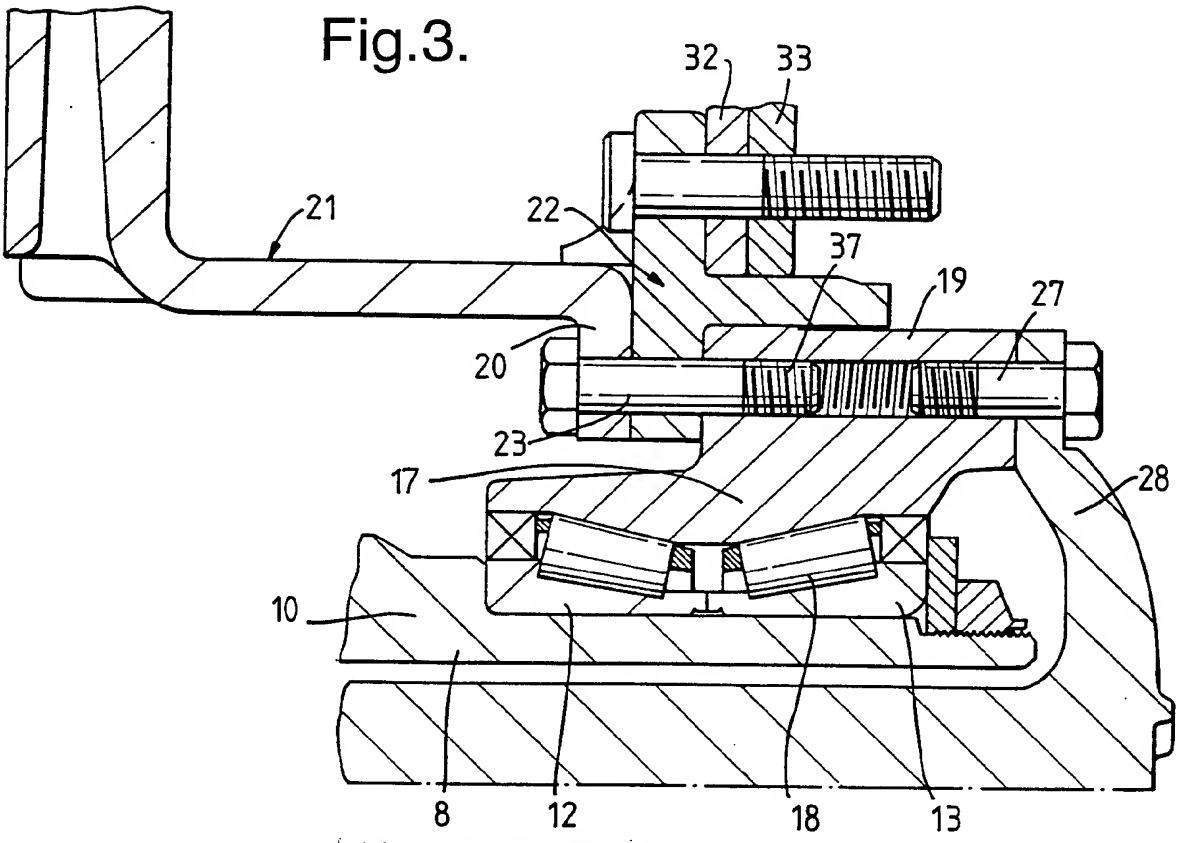
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Fig.4.

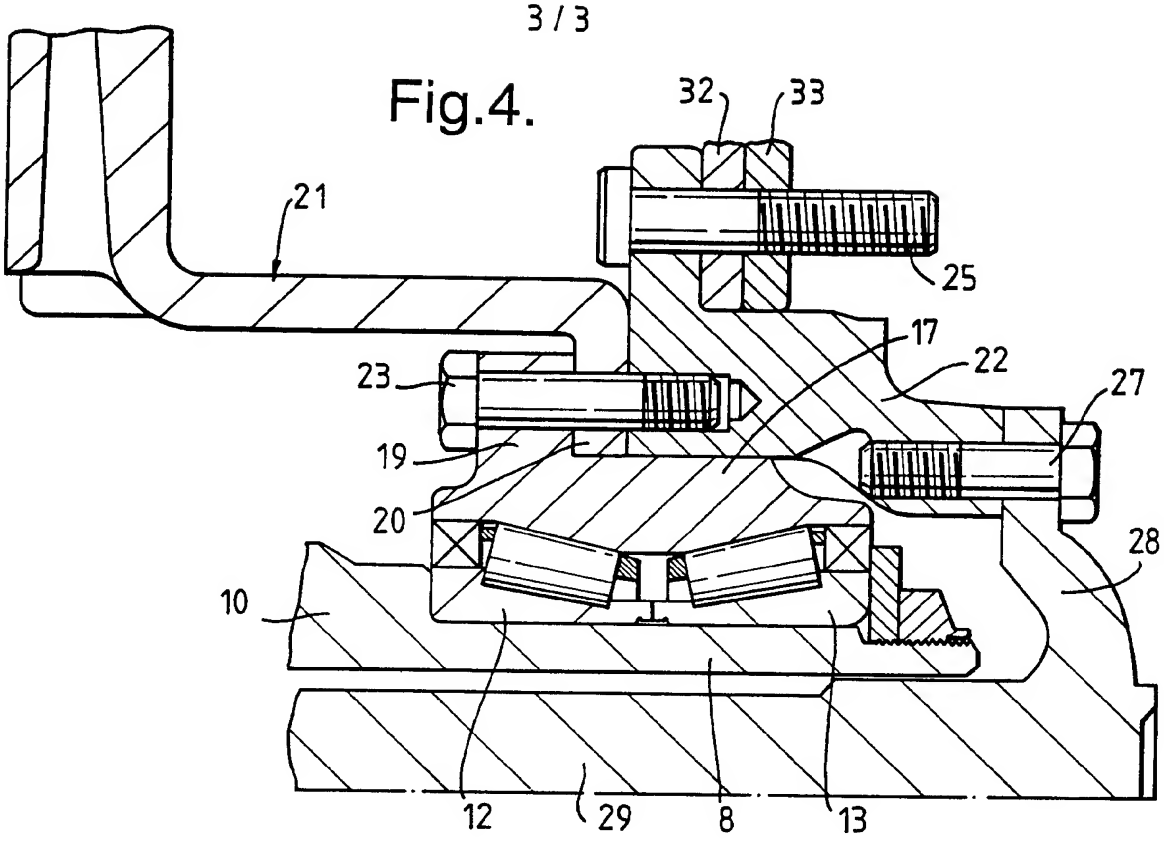
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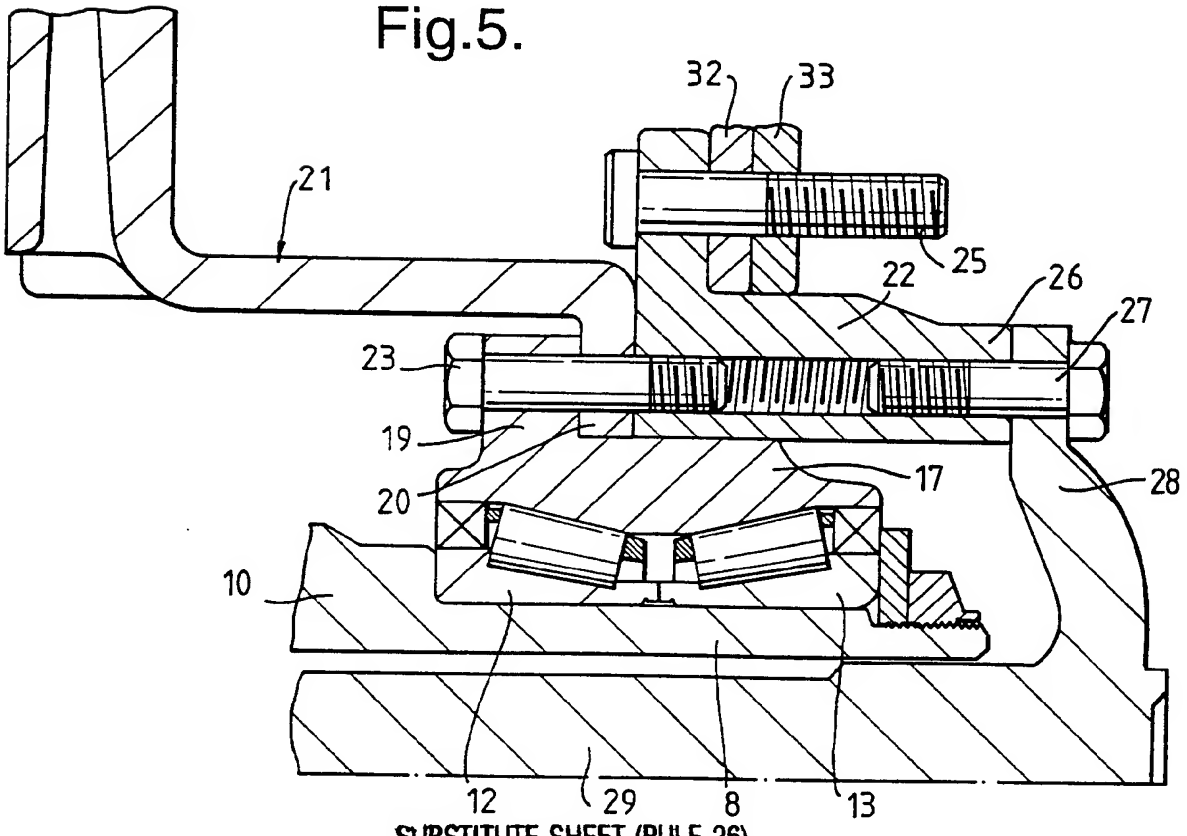
Fig.5.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INTERNATIONAL SEARCH REPORT

Intern. al Application No
PCT/GB 94/02493

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B60B27/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B60B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP,A,0 418 532 (IVECO FIAT) 27 March 1991 see column 2, line 7 - column 4, line 7; figures	1-7, 10-14
A	WO,A,86 02607 (ZAHNRADFABRIK FRIEDRICHSHAFEN) 9 May 1986 see claims; figures	1,2
A	FR,A,2 669 087 (SKF) 15 May 1992 see figures	1
A	DE,A,39 19 475 (DANA CORP) 1 February 1990 see claims; figures	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
22 February 1995	28.02.95

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Internal Application No
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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
EP-A-418532	27-03-91	DE-D-	69008088	19-05-94
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